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Salang Tunnel Feasibility Study Preliminary Findings

Presented by: TETRA TECH

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PRELIMINARY, FOR DISCUSSION PURPOSES ONLY

Overview

- Introduction (video)
- Factors to Consider
- Presentation of Options
- Presentation of Recommendations
- Questions & Answers

Factors to Consider

- Travel time and traffic demand
- Tunnel and roadway constructability issues
  - Traffic management
  - Need to keep corridor open during improvements
  - Tunnel/road widening constraints
  - Topography/geology
- Capital and Operation & Maintenance (O&M) costs
- Economic assessment
- Environmental impacts

Travel Time and Traffic Demand

- Current capacity 6,100 vpd
- Future demand:
  - 9,000 vpd (year-10)
  - 19,000 vpd (year-25)
- Goal - maximum 4-hour travel time

Evaluated Options

- Option 1 – Rehab Salang tunnel and approach road
- Option 2 – New tunnel next to Salang tunnel
- Option 3 – New roadway northeast of Salang tunnel
- Option 4 – New roadway via Goljabat Mountain
- Option 5 – Upgrade Bamyan-Doshi “bypass” road
- Option 6 – New 4-lane road to the east via Zenya-Banu

Option 1 – Rehabilitate Salang Tunnel and Approach Road

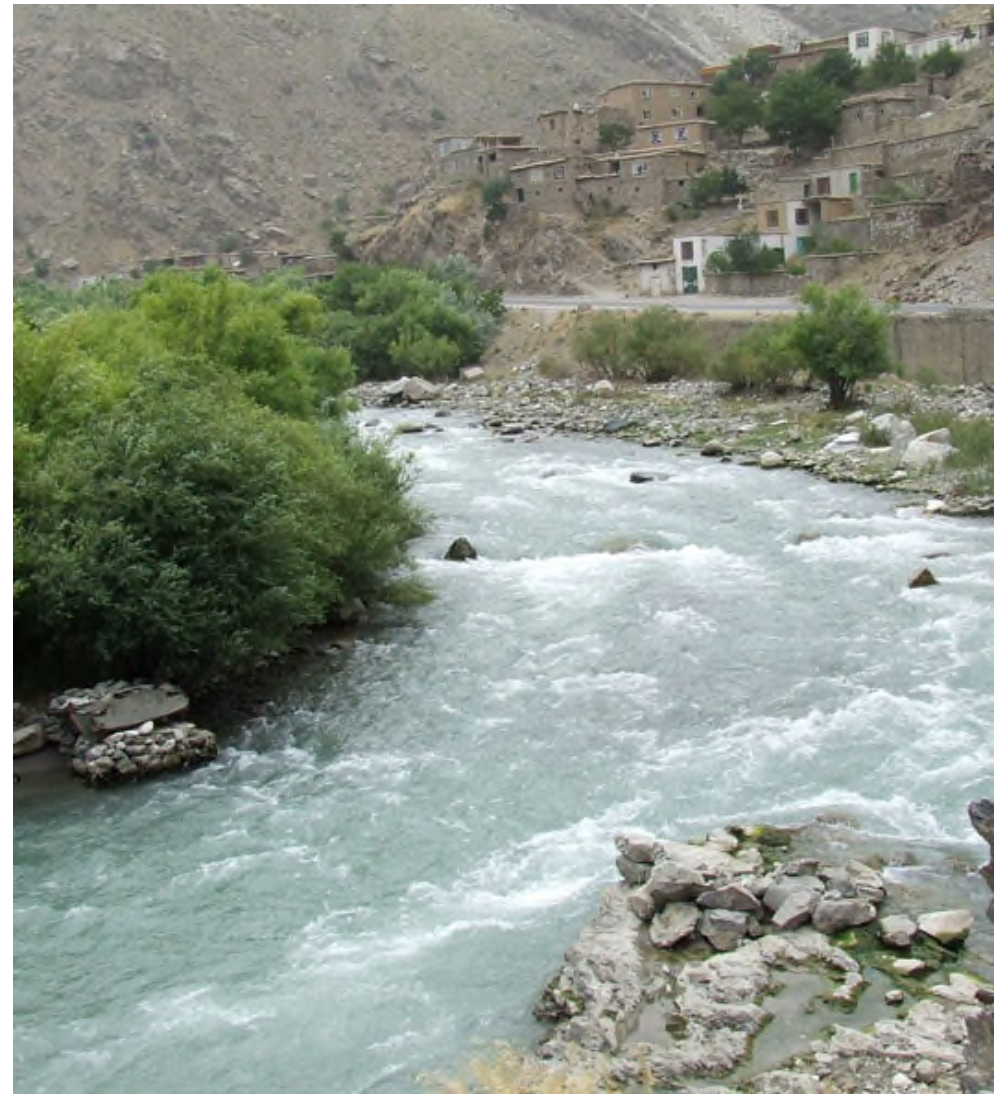
- Close tunnel
- Rehabilitate tunnel
- Rehabilitate existing two-lane road
- Reopen for travel

Option 1 Statistics

Features	Option I
Construction Cost	not evaluated
Capacity	not evaluated
LOS	not evaluated
Construction Duration	not evaluated
O&M Annual Cost	not evaluated
Travel Time	not evaluated
Cost/Benefit Ratio	not evaluated

Option 1 Pros and Cons

Pros	Cons
Improves safety and travel time	Tunnel closure makes option infeasible as no viable alternate route currently exists to accommodate north/south travel
Relatively short 36 month overall duration (design + construction)	



Option 2 - New Tunnel Next to Salang Tunnel

- New tunnel for NB traffic, rehab of existing tunnel for SB traffic
- Alternatives
  - 2A: 2-lane access road
  - 2B: 3-lane access road
  - 2C: 4-lane access road

Option 2A Statistics

Features	Option 2A 2-lane
Construction Cost	[redacted]
Capacity	9,200 vpd
LOS	D, possibly C
Construction Duration	48 mos
O&M Annual Cost	[redacted]
Travel Time	3 hours
Benefit/Cost Ratio	-0.057

Option 2B Statistics

Features	Option 2B 3-lane
Construction Cost	[redacted]
Capacity	11,400 vpd
LOS	D, possibly C
Construction Duration	54 mos
O&M Annual Cost	[redacted]
Travel Time	2.5 hours
Benefit/Cost Ratio	-0.114

Option 2C Statistics

Features	Option 2C 4-lane
Construction Cost	[redacted]
Capacity	32,700 vpd
LOS	D, possibly C
Construction Duration	60 mos
O&M Annual Cost	[redacted]
Travel Time	2 hours
Benefit/Cost Ratio	-0.047

Option 2 Pros and Cons

Pros	Cons
Maximizes use of the existing roadway infrastructure	High-elevation roadways: need to address winter travel issues
Favorable geologic conditions for tunneling	Relatively long overall duration (design + construction)
Allows phasing of roadway capacity improvements, climbing lanes	

Option 3 - New Roadway Northeast of Salang Tunnel

- 2-lane NB road from Olang to Doshak
- Two 2-lane NB tunnels
- Rehab Salang tunnel for SB traffic
- Reconstruct existing roads to 4 lanes

Option 3 Statistics

Features	Option 3
Construction Cost	[redacted]
Capacity	9,200 vpd
LOS	D, locally C
Construction Duration	60 mos
O&M Annual Cost	not evaluated
Travel Time	3 hours
Benefit/Cost Ratio	not evaluated

Option 3 Pros and Cons

Pros	Cons
Uses existing road network system	Crosses major fault zone: challenging for design and construction
Improves safety, traffic flow and speed	Unfavorable geologic conditions add to costs and schedule
	Relatively long overall duration (design + construction)

Option 4 - New Roadway via Goljabat Mountain

- New 4-lane Qalatak to Marghah road
- Convert dirt road Marghah to Khinjan to 4-lane road
- Alternatives
  - 4A: two 2-lane tunnels
  - 4B: no tunnel

Option 4A Statistics

Features	Option 4A with tunnel
Construction Cost	[redacted]
Capacity	32,700 vpd
LOS	C, locally B
Construction Duration	60 mos
O&M Annual Cost	not evaluated
Travel Time	4 hours
Benefit/Cost Ratio	not evaluated

Option 4B Statistics

Features	Option 4B no tunnel
Construction Cost	[redacted]
Capacity	32,700 vpd
LOS	C, locally B
Construction Duration	48 mos
O&M Annual Cost	[redacted]
Travel Time	2.5 hours
Benefit/Cost Ratio	0.296

Option 4 Pros and Cons

Pros	Cons
Alternative 4B with no new tunnel – less costly than Alternative 4A	Crosses major fault zone, unfavorable geologic conditions
Low elevations eliminate most of the snow galleries, providing relatively uninterrupted service	Requires at least Four months of winter snow removal/year
Improves safety, traffic flow and speed,	22,000-person community in approach areas may be affected, requiring full EA
Meets 25 year traffic demand	Relatively long overall duration (design + construction)

Option 5 - Upgrade Bamyan - Dushi 'Bypass' Road

- Upgrade Bamyan - Dushi road and Bamyan-Charikar road

Option 5 Statistics

Features	Option 5
Construction Cost	[redacted]
Capacity	9,200 vpd
LOS	C, locally B
Construction Duration	48 mos
O&M Annual Cost	[redacted]
Travel Time	7-8 hours
Benefit/Cost Ratio	-2.136

Option 5 Pros and Cons

Pros	Cons
No new tunnel, eliminates high elevation crossings	Under-designed roadways need reconstruction to withstand truck loads
Improves safety, traffic flow and speed	Route is 170 km longer, travels through unsafe areas
Can be year-round highway	Takes much longer to use this route, significantly increasing user costs
Provides a redundant route	Haul road construction not possible, and traffic must be partly stopped during construction
	Relatively long overall duration (design + construction)

Option 6 – New Four Lane Roadway to the East Via Zenya and Banu

- New four-lane roadway to the east

Option 6 Statistics

Features	Option 6
Construction Cost	[redacted]
Capacity	not evaluated
LOS	D, locally C
Construction Duration	not evaluated
O&M Annual Cost	not evaluated
Travel Time	10+hours
Benefit/Cost Ratio	not evaluated

Option 6 Pros and Cons

Pros	Cons
Possible future feeder connector to the Jalalabad Road	Requires a minimum 3-lane highway to maintain a C or D level of service
	Currently there is no road, just a dirt track
	Estimated length of 222 km of which about 150 km would be at elevations above 2,800 m
	It will likely require a 3,000-m tunnel, or crossing the ridge at elevations above 3,500 m

Key Findings

- Based on the engineering and economic analysis, the study team ranks **Option 4B**, a parallel 4-lane road from Qalatak to Marghah to Khinjan most viable
- Key Factors of Option 4B
  - [redacted] estimated construction costs
  - 48 months to complete
  - [redacted] estimated annual O&M Costs
  - Option does not require a tunnel
  - Option does not include rehab of existing Salang Tunnel
  - Only option that the economic analysis showed to have a positive Net Present Value
  - Level of Service improves from F to C, locally B

Key Findings Cont.

- Risk Factors of Option 4B
  - Possible negative impacts on populated areas, agricultural areas, and environmental damage from construction
  - Provides a single route without redundancy
- Key Actions of Option 4B
  - Requires a full environmental impact assessment to assess full spectrum of potential impacts

Key Findings Cont.

- If Option 4B were determined infeasible as a result of further social/environmental assessment, the next most viable option would be **Option 2A**, construction of a new two-lane tunnel for northbound traffic and rehabilitation of the existing tunnel and two lane road from Jabal Seraj to Khinjan for southbound traffic
- Key Factors of Option 2A
  - [redacted] estimated construction costs
  - 48 months to complete
  - [redacted] estimated annual O&M Costs
  - Includes rehab of Salang Tunnel once new tunnel complete
  - Level of Service improves from F to D, possibly C
  - Lower social/environmental impacts than Option 4B

Key Findings Cont.

- Risk Factors of Option 2A
  - Higher O&M costs associated with two tunnels
  - Provides only limited redundancy with a second tunnel
  - Does not meet 10-year and 25-year ADT projections under baseline ADT growth model, however, it is highest rated option under pessimistic ADT growth model
- Key Actions of Option 2A
  - Requires determination on Option 4B

Key Findings Cont.

- Economic Analysis

Economic Analysis Results for Each Option* (USD Millions)

Option	PV of Total Agency Costs (RAC)	PV of Agency Capital Costs (CAP)	Increase in Agency Costs (C)	Decrease in User Costs (B)	Net Present Value (NPV = B-C)	NPV/ Agency Cost Ratio (NPV/RAC)	NPV/ Capital Cost Ratio (NPV/CAP)	Internal Rate of Return (IRR)
0	[redacted]					0.000	0.000	0.0%
2A						-0.057	-0.065	11.2%
2B						-0.114	-0.125	10.6%
2C						-0.047	-0.052	11.5%
4B						0.296	0.312	14.9%
5						-2.136	-2.308	-

* Dollar values are in millions of USD.

Questions?